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THE WATER SUPPLY OF LONGVIEW, TEXAS[1]

By P. E. Green

This paper is a description of the installation of a new water supply for the city of Longview, Texas. It is not a detailed technical description of this work, though more or less technical data are given, but more emphasis has been laid on the human interest end of the problem because it is believed it is typical of many small towns in the United States, and because it illustrates so accurately the workings of human nature in our average city officials.

The city of Longview, Texas, is a community of about 7000 inhabitants. Up to within the last five or six years it has had practically no public improvements, except an antiquated water works system.

A few years ago a sanitary sewer system was installed under a franchise. Some four years ago this system was purchased by the city, and it is now operated by it, charges being made in a manner similar to that for ordinary water connections. There is a socalled disposal plant consisting of a small sedimentation tank and about 1600 square feet of broken brick filled beds for a filter. Incidentally it may be noted that the city makes a net profit of about 20 per cent per annum on the sewer system.

The existing water supply, before the installation of the one to be described in this paper, consisted of two deep wells, one of them 1200 feet and the other 600 feet in depth. From them the water was pumped by means of an ordinary air lift into two reservoirs, and from the reservoirs the water was pumped by means of two duplex steam pumps of 1,000,000 gallons capacity each, into a standpipe, having a capacity of about 75,000 gallons. The water from the wells is of a peculiar character. It is clear, sparkling, and of exceedingly pleasant appearance. It has, however, a very high chlorine salt content which makes it unsuitable for general commercial and domestic use. A typical analysis of this well is shown:

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[1] Read at meeting of Illinois Section, American Water Works Association, March 10, 1915.

	Parts per million
Suspended matter	None
Oxygen consumed	2.8
Organic nitrogen	0.33
Albuminoid of ammonia	0.08
Free ammonia	2.23
Nitrites	0.12
Nitrates	0.10
Chlorine	1160.00
Alkalinity	368.00

From the above it will be seen that the chlorine ran to 1160 p.p.m. Other analyses have shown as high as 1600 p.p.m. The alkalinity is also high, amounting to 368 p.p.m.

The water is decidedly salty in taste, though after using it for a time many people declared that they did not longer notice the taste of salt. On a stranger, its effect was frequently quite laxative, and lawns, etc., were soon ruined if it was used for sprinkling. However, in addition to its character, the supply was very limited, and while, when the wells were first installed as much as 300,000 gallons per day was obtained, this yield steadily dropped and ultimately it was difficult to get more than 100,000 gallons per day out of both wells. About 2000 people are served by the water and sewer system.

In 1911 and 1912 several disastrous fires occurred, during which there was practically no water available, and the mayor and city council, as well as the people generally, appreciated the fact that a new water supply was absolutely necessary. The writer was therefore commissioned to make an investigation of the subject.

There were three sources of supply to be considered: 1st, an artificial lake, known as Lake Lemont, about a mile west of the city; 2d, a small stream called Grace's Creek, running through the city; and 3d, the Sabine River, distant about three miles and a half from the city. Lake Lemont has a drainage area of about seven square miles. The Lake is about a mile long and from a quarter to one-half of a mile in width, and averages about five feet in depth. This lake is used for fishing and hunting purposes only. The investigation showed that its shallowness and limited water shed, together with the long continued dry spells which are characteristic of that part of the country, make it unsuitable as a source of supply.

The investigation of the second project, Grace's Creek, as it was called, developed that there was no available site for a dam, although the water shed is approximately 25 square miles in area above the town.

This left the river as the only available source. The Sabine River above Longview has a water shed area of about 2900 square miles. The population on the water shed was about 136,000, almost entirely rural. From the very limited government data on the subject it was determined that the minimum flow would be about thirty cubic feet per second. The rainfall averaged about forty inches, and the run off from 10 per cent to 30 per cent. At times several months passed with no rain whatever.

Analyses were made of the Sabine River water, the water of Lake Lemont and of Grace's Creek, of which typical examples are included herewith:

LOCALITY	SABINE RIVER			GRACE'S CREEK	LAKE LEMONT	
	1912					
Date of collection	Feb. 13	Feb. 16	Feb. 28	Feb. 16	Feb. 13	Feb. 28
Date of analysis	Feb. 16	Feb. 19	March 1	Feb. 19	Feb. 15	March 1
Physical analysis:						
Turbidity	60	75	120	40	60	50
Color	75	70	85	70	60	75
Odor	None	None	None	None	None	None
Sediment	Slight	.....	Slight	.....	Very slight	None
Chemical analysis:						
Suspended matter						
Total	23.000	21.00	39.000	7.00	16.000	16.000
Volatile	5.000	9.00	5.000	6.00	3.000	8.000
Fixed	18.000	12.00	34.000	1.00	13.000	8.000
Oxygen consumed	5.300	5.10	6.700	6.00	3.800	5.200
Nitrogen as:						
Organic nitrogen	0.340	0.24	0.360	0.17	0.410	0.520
Albuminoid ammonia	0.120	0.13	0.180	0.14	0.170	0.240
Free ammonia	0.004	0.12	0.016	0.12	0.120	0.088
Nitrites	0.000	0.00	0.000	0.00	0.001	trace
Nitrates	0.020	0.00	0.020	0.00	0.060	0.060
Chlorine	16.000	16.00	18.000	13.00	6.000	7.000
Total hardness	44.000	35.00	33.000	35.00	35.000	23.000
Alkalinity	20.000	22.00	20.000	18.00	22.000	22.000
Iron	1.000	1.00	1.000	1.00	trace	trace

Bacterial investigation showed that all the sources of supply were more or less contaminated, but none seriously. It was therefore recommended that a 1,000,000 gallon mechanical filter plant be built at the edge of the river, some three miles and a half from the city, and the water pumped from there to a new modern elevated tank.

The presentation of the report developed some very lively opposition to the river project. It was commonly stated that during the "black rise" the river was and always would be absolutely unsuitable for drinking purposes, that it would be salty, full of organic matter, etc., etc. This, in spite of the fact that very complete information had been obtained of the water shed, and nothing had developed which would indicate that at any time there would be any great difficulty in filtering the water, though it might be very hard sometimes. It also developed that there was a very strong sentiment in the city for the use of Lake Lemont, the first source of supply mentioned, as the location for the filtering plant. This was because it was so close to the city. However, the report was accepted, leaving the question of the source of supply to be later decided.

After the necessary bonds were voted there was a period of several months in which nothing was done. The bond market was bad, and no serious fires had occurred. As soon as the bonds had been voted the mayor and city council were deluged with letters and visits from promoters of various devices for purifying water, each sure that his device was the only one to secure the result desired, and all of them willing to absorb the cost of engineering in their price, so that the city would not be put to that unnecessary expense. Some of them were backed by very strong local sentiment through business connections, relatives, etc.

After three or four months of this kind of promotion the council was considerably bewildered. They very naturally desired to get the best plant at the least cost. Finally, as a sort of a compromise and with a shadowy idea that possibly there might be oil, since everyone was talking oil in this part of the world, it was decided to sink another well near the site of the old wells. Accordingly, a deep well drilling apparatus and a quantity of iron casing were purchased and a start made on drilling a well. This was soon abandoned and the outfit was later sold to a well drilling company.

About this time there was a small outbreak of typhoid fever in the city which alarmed the mayor and council. They promptly sent samples of the well water to Chicago and to Dallas for analysis, and these analyses developed the fact that the water was suspicious, B. coli being found by both analyses. It was decided, however, that the cause of the contaminated water was in the condition surrounding the wells, and this condition was promptly remedied, and as promptly it was decided to go ahead with the Sabine River project.

Plans and specifications were then prepared, providing for a mechanical filtration plant of 1,000,000 gallons capacity, having two filter beds, a sedimentation basin of 500,000 gallons capacity, and a coagulation basin of 100,000 gallons capacity. Besides the filter plant proper there was included in the scheme a tunnel intake, two low-lift centrifugal pumps of 700 g.p.m. capacity, driven by 2300-volt, 60-cycle, 3-phase motors. Two high-lift pumps were provided, one, a 750-gallon 3-stage centrifugal, motor driven, and one 650-gallon, motor driven triplex. In addition a steam duplex pump was provided, for emergency high-lift pumping, and a small generator set to drive the low-lift pumps and light the plant in case of failure of the current. The current, furnished by a local company, was taken off at 2300 volts and stepped down for lighting. Alternative proposals were also invited on the filter plant, plans to be submitted by bidders.

Proposals for bids were advertised for and received. Since alternative proposals were possible the field of bids was quite broad. In general the alternatives proposed by the best of the filter companies provided a lesser time of sedimentation than the engineer's plans.

In several small cities in that part of Texas the crude scheme of settling surface water by means of dosing it with alum and allowing it to settle in small shallow circular basins had developed. The dosing apparatus of such a plant had been patented and the patentee, or his successors, had formed a company and sold the device to some active business man of a nearby city. This company, after the bonds were voted, became very urgent in an endeavor to secure the installation of their device, and submitted a bid. This was the only departure from standard practice proposed. It may be said that it was simply an adaptation of the St. Louis system on a small scale, without either the expert supervision or facilities for sedimentation possessed by the city of St. Louis.

The plans for a filtration plant, providing for six hours sedimentation, were finally accepted at a cost of about $5000 under that of the engineer's plans, it seeming to be the unanimous opinion of the able engineers representing the various filter companies that the saving was justified.

The work has now been constructed and is just starting operation, though not fully tuned up yet. The city of Longview, after some three years of strenuous discussion, has now a first-class water supply. The total cost of the intake, filtration plant, three and one-half miles of 12-inch force main, a new 150,000 gallon elliptical bottom elevated tank, pumping machinery, motors, and auxiliary steam pumping plant, is about $150,000, not including engineering.

As yet not much trouble has been experienced in handling the water, though at the time of this writing, February 3, the water is exceedingly turbid, and the alkalinity is very low. After 24 hours plain sedimentation there is no apparent reduction of turbidity. The beds are washed by taking water from the force main, in which the pressure is about 125 pounds. This is a mistake. A wash water tower should have been provided, since the ordinary pumpage, 650 gallons, is not enough to wash. Therefore no checks could be used between the wash water take off and the stand pipe. At the end of the first week of operation, the too sudden opening of the wash water valve caused a surge which sheared off several of the laterals and cracked the header. Gauge readings showed that the force main is subject to a pressure ranging from 60 to 160 pounds as the pumps are stopped or started. To remedy this a relief valve and automatic air valves have been installed.

The usual troubles with air pockets, best places for dosing, etc., have been encountered. It has been found for instance that applying the alum at the low lift pumps produces the best results for very turbid water. The best bacterial results have been obtained when the hypo is added about ten minutes before the filter beds.

Mr. H. N. Roberts, C.E., was the resident engineer in charge of the work and is now city engineer in charge of the operation of the plant.